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RECREATIONS IN MATHEMATICS AND NATURAL PHILOSOPHY.

The following are answers to the two queries proposed in our 130th Number.

1. The origin of this problem is related in so curious a manner by Al-Sephadi, an Arabian author, that it deserves to be mentioned. A mathematician, named Sessa, says he, the son of Dahier, the subject of an Indian prince, having invented the game of chess, his sovereign was highly pleased with the invention, and wishing to confer on him some reward worthy of his magnificence, desired him to ask whatever he thought proper, assuring him that it should be granted. The mathematician, however, only asked a grain of wheat for the first square of the chess-board, two for the second, four for the third, and so on to the last or sixty-fourth. The prince at first was almost incensed at this demand, conceiving that it was ill-suited to his liberality, and ordered his vizier to comply with Sessa's request; but the minister was much astonished when, having caused the quantity of corn necessary to fulfil the prince's order to be calculated, he found that all the grain in the royal granaries, and that even of all his subjects, and in all Asia, would not be sufficient. He therefore informed the prince, who sent for the mathematician, and candidly acknowledged that he was not rich enough to be able to comply with his demand, the ingenuity of which astonished him still more than the game he had invented.

Such then is the origin of the game of chess, at least according to the Arabian historian Al-Sephadi. But it is not our business here to discuss the truth of this story; our business being to calculate the number of grains demanded by the mathematician, Sessa.

It will be found by calculation, that the 64th term of the double progression, beginning with unity, is 9223372036854775808. But the sum of all the terms of a double progression, beginning with unity, may be obtained by doubling the last term and subtracting from it unity. The number, therefore, of the grains of wheat equal to Sessa's demand, will be 18446744073709551615. Now, if a standard pint contains 9216 grains of wheat, a gallon will contain 73728, and, as eight gallons make one bushel, if we divide the above result by eight times 73728, we shall have 31274997412295 for the number of the bushels of wheat necessary to discharge the promise of the Indian king; and if we suppose that one acre of land is capable of producing in one year, thirty bushels of wheat, to produce this quantity would require 1042499913743 acres, which make more than eight times the surface of the whole globe; for the diameter of the earth being supposed equal to 7930 miles, its whole surface, comprehending land and water, will amount to very little more than 126487889177 square acres.

Dr. Wallis considers the matter in a manner somewhat different, and says, in his Arithmetic, that the quantity of wheat necessary to discharge the promise made to Sessa, would form a pyramid nine miles English in length, breadth, and height; which is equal to a parallelopiped mass, having nine square leagues for its base, and of the uniform height of one league. But as one league contains 15840 feet, this solid would be equivalent to another one foot in height and having a base equal to 142560 square leagues. Hence it follows, that the above quantity of wheat would cover, to the height of one foot, 142560 square leagues; an extent of surface equal to eleven times that of Britain, which, when every reduction is made, will be found to contain little more than 12674 square leagues.

If the price of a bushel of wheat be estimated at ten shillings, the value of the above quantity will amount to £15637498706147 10s. a sum which, in all probability, far surpasses all the riches on the earth.

2. By calculating as before, the 24th term of the progression 1, 2, 4, 8, &c. will be found to be 8388608, equal to the number of farthings the purchaser ought to give for the horse. The price therefore amounted to £3738 2s. 8d. which is more than any Arabian horse, even of the noblest breed, was ever sold for.

Had the price of the horse been the value of all the

nails, at a farthing for the first, two for the second, four for the third, and so on, the sum would have been double the above number, minus the first term, or 16777215 farthings, that is £17476 5s. 3½d.

Judging by the same system of calculating, it is not astonishing that the race of Abraham, after sojourning two hundred and sixty years in Egypt, should have formed a nation capable of giving uneasiness to the sovereigns of that country. We are told in the sacred writings, that Jacob settled in Egypt with seventy persons: now if we are to suppose that among these seventy persons, there were twenty too far advanced in life, or too young, to have children; that, of the remaining fifty, twenty-five were males and as many females, forming twenty-five married couples, and that each couple, in the space of twenty-five years produced, one with another, eight children, which will not appear incredible in a country celebrated for the fecundity of its inhabitants, we shall find that, at the end of twenty-five years, the above seventy persons may have increased to two hundred and seventy; from which, if we deduct those who died, there will, perhaps, be no exaggeration in making them amount to two hundred and ten. The race of Jacob, therefore, after sojourning twenty-five years in Egypt, may have been tripled. In like manner, these two hundred and ten persons, after twenty-five years more, may have increased to six hundred and thirty; and so on in triple geometrical progression: hence it follows that, at the end of two hundred and twenty-five years, the population may have amounted to 1377810 persons, among whom there might easily be five or six hundred thousand adults fit to bear arms.

If we suppose that the race of the first man, making a proper reduction for those who died, may have been doubled every twenty years, which certainly is not inconsistent with the powers of nature, the number of men, at the end of five centuries, may have amounted to 1048576. Now, as Adam lived about nine hundred years, he may have seen, therefore, when in the prime of life, that is to say, about the five hundredth year of his age, a posterity of 1048576 persons.

QUERIES IN GEOMETRICAL PROGRESSION.

1. A club of seven persons agreed to dine together, every day successively, as long as they could sit down to table differently arranged. How many dinners would be necessary for that purpose?

2. Fifteen Christians and fifteen Turks being at sea in the same vessel, a dreadful storm came on, which obliged them to throw all their merchandize overboard; this however not being sufficient to lighten the ship, the captain informed them that there was no possibility of its being saved, unless half the passengers were thrown overboard also. Having, therefore, caused them all to arrange themselves in a row, by counting from 9 to 9, and throwing every ninth person into the sea, beginning again at the first of the row when it had been counted to the end, it was found that after fifteen persons had been thrown overboard, the fifteen Christians remained. How did the Captain arrange these thirty persons so as to save the Christians?

"THE FORGET-ME-NOT."

This, the last of the *Annuals* for 1835 which it is our intention to notice, when formed into rank with the numerous class of publications of a similar order, which have recently appeared before the public, must be allowed to pass muster with considerable credit. We are compelled to say, however, that while it contains nothing which can in any way be offensive to a correct taste, or a cultivated understanding, there is nothing whatever of that impress of genius which we should expect to find in such a publication. No doubt, in several of the illustrations there is considerable cleverness, but in none of them can we discover anything which we could pronounce as an effort of real genius; and the same remark may be applied to the prose and poetry throughout the volume. Now, if we mistake not, it was with an intention of enabling artists of genuine talent to bring before the public efforts of the pencil or the chisel, that the *Annuals* were at first established. How far this was the case in earlier years we will not pretend to say, assuredly in by far the greatest